Contents

1. Safety precautions
2. Introduction (R.C.C. and Masonry)
3. Masonry
    a. Brick, Different types of brick
    b. Bonds used in brick
    c. Stone masonry
    d. Definition of mortar, different types of mortar
    e. Job : Bonds in Brick work, Header, Stretcher and English bond
4. R.C.C.
    a. Different parts of R.C.C. building
    b. Definition of R.C.C. and C.C.
    c. Materials used in R.C.C. building, mixing of concrete
    d. Tools & Equipments of R.C.C. and Masonry
    e. Job : Bending and binding of M/S rods for R.C.C. structure — hook, stirrup.

Safety Precautions

1. Always wear shoes and workshop dress while working in the workshop.
2. Do not wear loose dress in the workshop.
3. Do not talk with others while working.
4. Work should be done as per the advice of the workshop teacher.
5. Check all the instruments before and after use.
6. Damaged tools like with broken handle should not be used.
7. Tools should be clean and sharp well in order after use.
8. Keep all the articles in proper place.

Masonry

Masonry is the art of work in construction using brick or stone as a building material. When brick or stone as a building material is used, brick units bonded together with mortar in construction. of masonry is called brick masonry. It is used for the construction of walls, columns, lintels, arches, footing etc.

Bricks

Brick is one of the oldest building material and it is used extensively at present times as a leading material of construction because of it's durability, strength, reliability, low cost, easy availability etc.

Bricks are obtained by moulding clay in rectangular blocks of uniform size, and then by drying and burning these blocks. As bricks are of uniform size, they can be properly arranged and further, as they are light weight, no lifting appliances is required for them. Thus, at places of stone unavailability, plenty of clay, brick replaces them.

A good earth brick should be composed of clay or alumina (20 – 30 %), silica or sand (35 – 50%) and other ingredients are lime, oxide of iron, Sodium, manganese, potassium and magnesia. All of these should be 1 – 2 % by weight.

Bureau of Indian Standard has fixed up the size of standard modular block to be 19 cm long x 9 cm wide x 9 cm thick after manufacture. The nominal size i.e. with mortar is 20 cm x 10 cm x 10 cm.

The clay bricks are classified as —

i] 1st Class

ii] 2nd Class

iii] 3rd Class

iv] Jhama brick

Characteristics of Bricks :

1st Class bricks :

1. The brick should be reddish and uniform in colour.
2. If 2 bricks are struck together it should emit ringing sound.
3. Water absorbing capacity should be within limits.
4. It should have proper shape and size and weight.
5. The bricks should not break into pieces when dropped flat on hard brown from a height of about 1 meter.

2nd Class bricks :

1. These bricks are ground moulded and burnt in kilns.
2. The surface is somewhat rough and shape is slightly irregular, may have hair cracks & edges may not be sharp & uniform.

3rd Class Bricks :

1. These bricks are ground moulded and burnt in clamps.
2. These are not hard and have rough surfaces with irregular & distorted edges.
3. These give dull sound when struck together.

Jhama bricks :

1. These are over burnt bricks with irregular shape & dark colour.
2. These are used as aggregate for concrete in foundation, floors, roads.

Bonds used in Brick work :

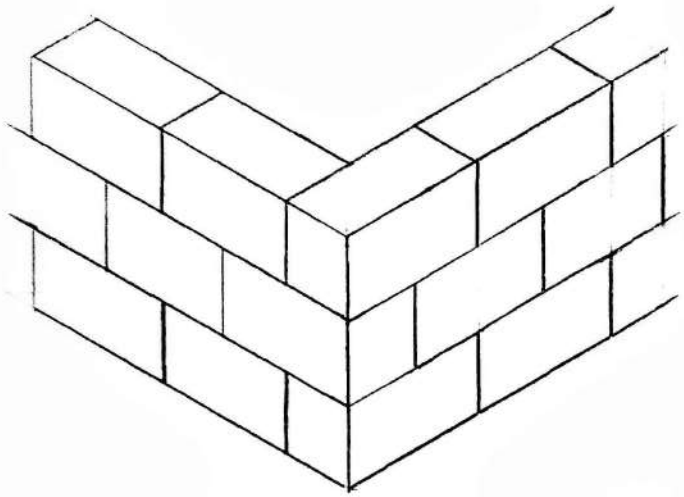
The bricks are manufactured in proper size and shape. Thus these can be arranged in various patterns and designs. The laying of bricks in different patterns are called type of bonds. To eliminate continuous vertical joints in the body and face of the walls, the bonding is very essential. The various types of bonds commonly used in the Brick masonry construction are — 1) English bond
2) Flemish bond

1) English bond : The bond consists of alternate course of header and stretchers. For breaking the veitical joints in the successive course, a queen closer is placed after the 1st header in each heading course. The heading course should not start with queen closer, for this head the walls with one brick, 2 bricks and 3 bricks thickness presents the same lock on both the faces.

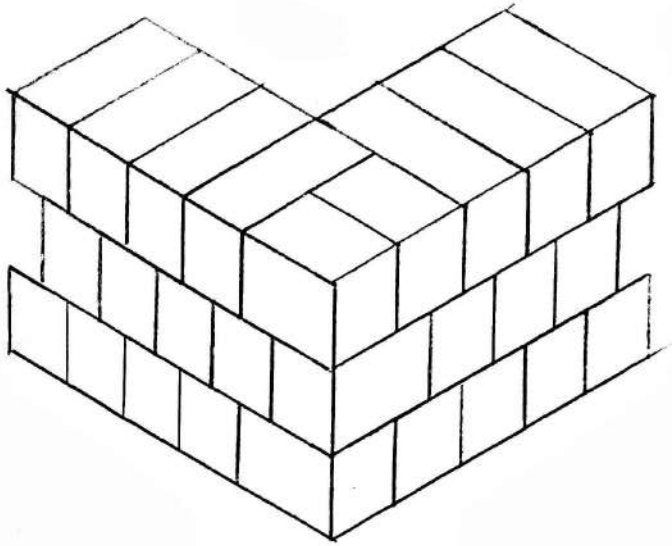
2) Flemish bond : This bond consists of alternate header and stretchers in each course. Every alternate course starts with a header of the corner. The bond is of 2 types — a) Single Flemish bond
b) Double Flemish bond

There are some other types of bonds which are not commonly used but their use is restricted to some special types of construction. These are —

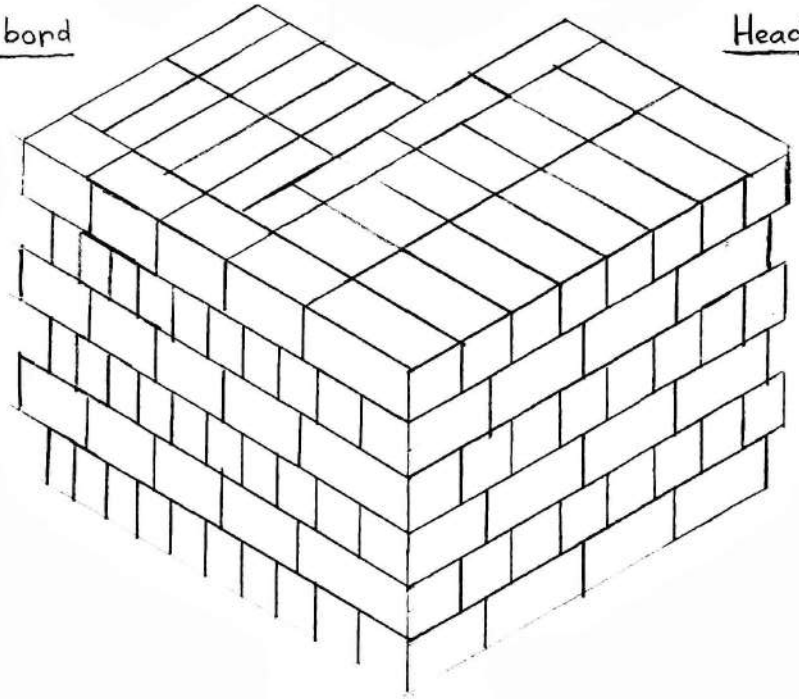
a) Heading bond
b) Stretching bond
c) Diagonal bond
d) Garden wall bond
e) Herring bone bond
f) Zigzag bond
g) English Cross bond
h) Dutch bond



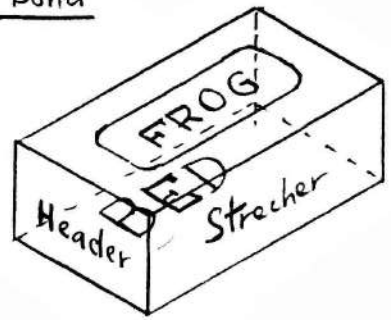
Stretcher bond



Header bond



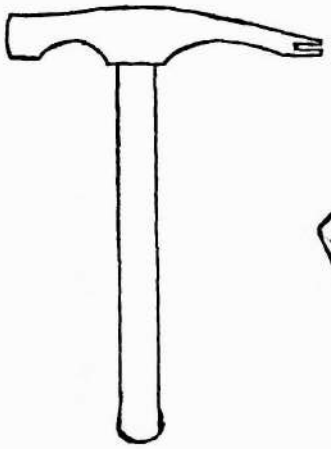
English bond



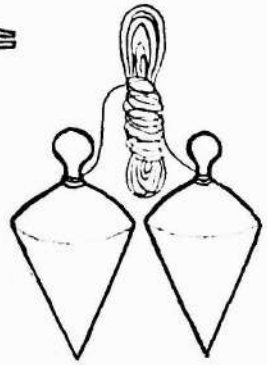
Brick

MASONRY TOOLS

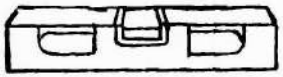
Trowel



Scutch



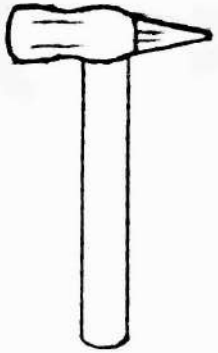
Line and pins



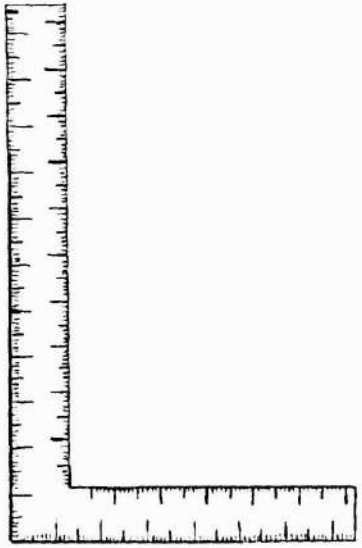
Spirit level

Brick axe

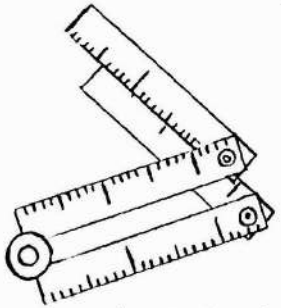
Plumb rule



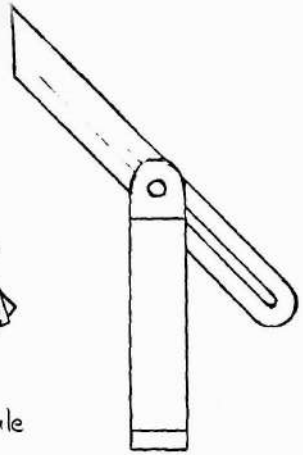
Brick hammer



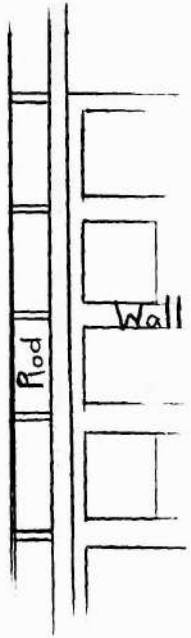
Mason's square



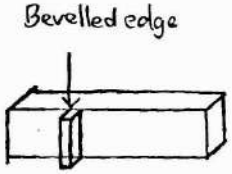
1 meter-4 fold rule

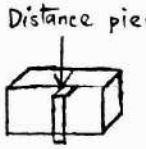


Bevel

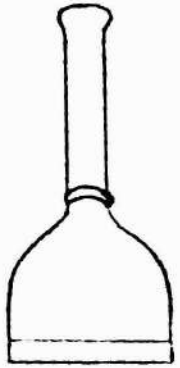


Gauge rod





Pointing rule



Bolster

Mortar

Definition: When binding materials (cement, lime), fine aggregate (sand) mixed in a definite proportion with water is called mortar. The proportions are 1:3, 1:5 and 1:8.

Different types of Mortar:

1] Cement mortar
2] Lime mortar
3] Lime cement mortar
4] Lime surkhi mortar
5] Mud mortar

Cement mortar: Generally used in brick masonry, the most used, cement mortar is a homogeneous mixture of cement, sand & water in appropriate proportion.

Stone Masonry

Using stone in masonry construction is called Stone masonry, after cutting and dressing them to proper shape and size. It is used for construction of walls, columns, lintels, arches, footings etc of the buildings, mostly of hilly areas and mostly in monumental structures. Usually cement mortars are used in stone masonry.

Most common type of stones found in India are Granite, Sandstone, Limestone, Marble etc.

Granites are the hardest type of stone, available in various colours, used in shapes, walls etc.

Sandstones contain Mica, Felsper and Iron. It is used for walls, steps, columns, flooring etc and importantly in monumental structures. These are also available in various colours.

Practical 1

Name of the job: Bonds in Bricks

Aim of the job: To construct header, and stretcher bond and English bond

Material required: Cement, Sand and Water

Tools used:

1) Trowel: It consists of a flat steel blade and shank into which a wooden handle is fixed. It is used for lifting and spreading mortar onto wall, cutting brick.
2) Brick hammer: It is used for cutting bricks to the required shape and size. One edge of it is sharp while other is square.
3) Scutch: It is used for cutting soft bricks and dressing surfaces.
4) Line and Pins: The line is wound round 2 pins. It is used to maintain correct alignment rourses.
5) Spirit level: It is used for getting horizontal surfaces.
6) Brick Axe: Its purpose is similar to brick hammer.
7) Plumb rule: It is used to check verlically of brick or stone wall.
8) Mason's square: It is made of wood or steel, used for checking right angles.
9) 1 meter rule: It is in the shape of 4 fold used for taking measurements.
10) Bevel: It is used for setting out angles.
11) Bolster: It is a chisel or steel having a very wide blade, used for cutting brick.
12) Pointing rule: It is used to maintain mortar joints between brick bonds.

Procedure :

i] Firstly, selected bricks are worked on to be crack free, roll free and flow free, also well burnt, hard, having uniform size and shape with colour.

ii] The bricks to be used for masonry should be soaked in clean water for al least an hour ora day before use.

iii] Mortar is prepared with 1:5 proportion of cement and sand with water as required.

iv] To prepare header bonds, bricks are laid as headers on the faces, used mostly in full brick walls.
To prepare stretcher bonds, bricks are laid as stretchers on the faces, used mostly in half brick walls.

v] Alignment is checked using line and pins during laying bricks.

vi] Vertical joints are checked by plumb rule.

vii] All the horizontal courses are checked with spirit level.

viii] Thickness of joints shuldbe checked simutaneously not to exceed 10 mm.

Different Parts of R.C.C. Building

A] Post or Column
B] Slab
C] Stair case
D] Tie beam
E] Lintel
F] Chaja

Definitions:

i) **R.C.C.** : The combination of M/S rod and cement concrete is called R.C.C. or Reinforced Cement Concrete.

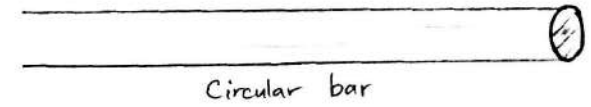
ii) **C.C.** : When cement, sand, stone and water is mixed in definite proportions, then it is called Cement Concrete. Eg – 1:2:3, 1:3:5, 1:5:8 etc.

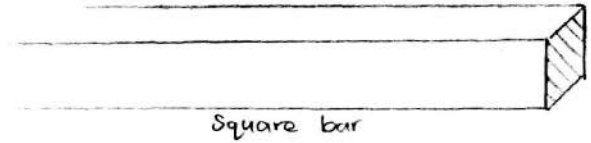
Description of materials used in R.C.C.:

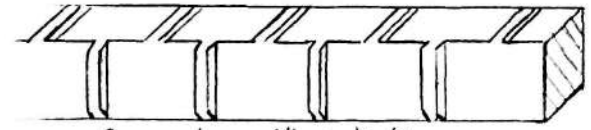
[I] **M/S Steel bar:** —— a) Plain Steel bar — round, square
b) Twisted steel bar

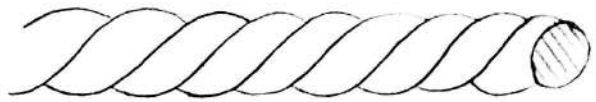
Different sizes and dimensions of steel bars are—

6 mm ϕ → 0.22 kg/m
8 mm ϕ → 0.39 kg/m
10 mm ϕ → 0.62 kg/m
12 mm ϕ → 0.89 kg/m
16 mm ϕ → 1.62 kg/m
18 mm ϕ → 2 kg/m
20 mm ϕ → 2.47 kg/m


Circular bar


Square bar


Square bar with inclinations


Twisted bar

[II] Cement:

Cement is hygroscopic material which readily absorbs moisture or water. It consists of 4 things —

a) Tri Calcium aluminate
b) Di Calcium silicate
c) Tetra Calcium alumino ferrite
d) Tri Calcium silicate

Different types of cement are —

i) Portland cement
ii) Rapid hardening cement
iii) Quick setting cement
iv) Blast furnace slag cement
v) White cement
vi) High alumina cement
vii) Low Heat cement
viii) Coloured cement

i) Portland cement:

It consists of —

a) Lime (CaO) → 62 %
b) Silica (SiO_2) → 22 %
c) Alumina (Al_2O_3) → 5 %
d) Calcium Sulphate ($CaSO_4$) → 4 %
e) Iron Oxide (Fe_2O_3) → 3 %
f) Magnesia (MgO) → 2 %
g) Sulphur (S) → 1 %
h) Alkalis → 1 %

Sulphur Tri Oxide (SO_3) etc....

[III] Sand (Fine Aggregate)

This is the inert or chemically inactive material most of which passes 4.75 mm sieve. There are 3 types of fine aggregate —

a) Natural sand
b) Crushed stone sand
c) Crushed gravel sand

[IV] Stone (Coarse aggregate)

This the inert material most of which is retained on 4.75 mm sieve and contains not more than 0-10% finer material, is known as coarse aggregate. There are 3 types of coarse aggregate —

a) Natural stone
b) Crushed gravel
c) Partially crushed gravel

Selection of aggregates: Aggregates are produced by the disintigration of rock and by crushing gravel rock. Coarse aggregates are those particle which are retained on an IS 4.75 mm sieve and fine aggregates are those which pass through. Conditions for usage —

i) For RCC. work coarse aggregate having nominal size 20 mm and fine aggregate i.e. sand is obtained from sea beaches or river banks.

ii) The aggregates should be absolutely clean ie. free from organic matter or any other.

iii) Water to be used in mixing and curing must be clean and free from injurious materials of oils, acids, alkaline, salts, sugar, organic matter.

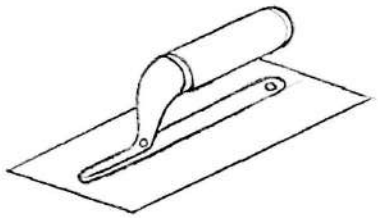
Tools used in R.C.C. and Masonry

1. Hacksaw
2. Dye
3. Hook
4. Ball peen hammer
5. Trowel
6. Claw hammer
7. Iron Pan
8. Shovel
9. Spade
10. Bucket
11. Mesh
12. Floating rule
13. Skimming float
14. Laying trowel
15. Measuring tape (5 m, 10m, 20m, 30m, 50m)
16. Pipe level
17. Spirit level
18. Line and pins
19. Try square
20. Gauge rod
21. Brick hammer

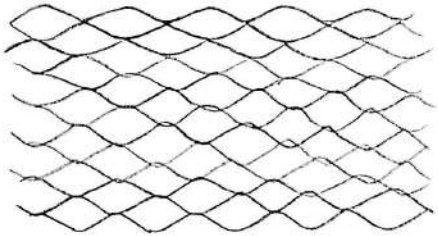
Machines used in R.C.C.

1) Tilting drum mixture machine
2) Needle vibrator
3) Wheel barrows
4) Marble cutter

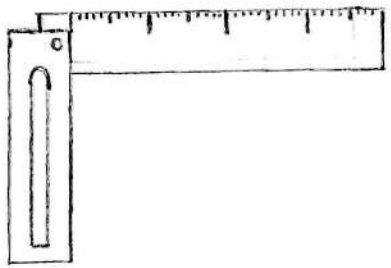
Additional tools in R.C.C. other than Masonry



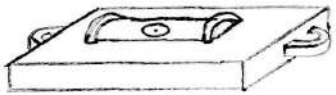
Skimming float



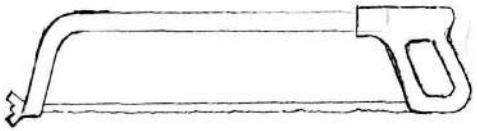
Mesh



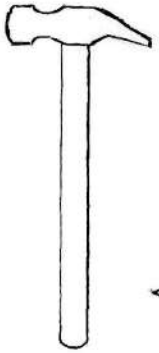
Try square



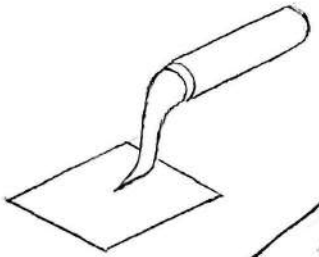
Bubble rule



Hack saw

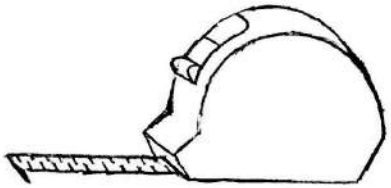


Claw hammer



Laying trowel

Shovel



Measuring tape

Concrete Mixing :

1] Hand mixing : The simplest methods used for concrete mixing is manual, when hand mixing is adopted, 10% extra cement is added. The manual procedure consists —

a) Fine aggregate is laid evenly on a clean water tight platform in proper manner.
b) The cement layer is laid and spread over the top uniformly with shovel.
c) After mixing dry cement and sand 2 to 3 times it is mixed again 2-3 times after mixing water, until colour is uniform.

2] Machine mixing : Tilting drum mixture machine is used for mixing concrete, which can be of batch mixing type or continuous mixing type. For building purposes, batch mixing type is generally used with tilting drum type concrete mixture. Coarse aggregate is 1st fed in the machine, then sand and lastly the cement. After dry mixing water is poured and thoroughly mixed for 1.5 to 2 minutes.

Practical 2

Name of the job : Stirrup of an RCC. post of dimensions 300 mm × 300 mm

Calculations :

Post size = 300 mm × 300m

Clear cover = 40 mm

Diameter of bar = 8 mm

Longitudinal bar or main bar = 10 mm

Hook length = 9d (d = ϕ of bar)

$\therefore$ a = 300 - (2× Clear cover)
= 300 - (2 × 40)
= 300 - 80
= 220 mm

b = 300 - (2× Clear cover)
= 300 - (2 × 40)
= 300 - 80
= 220 mm

Cutting length of the stirrup = 4a + (2 × 9d)
= (4 × 220) + (2 × 9 × 8)
= 880 + 144
= 1024 mm
= 1.024 m

Date of beginning and finishing	Materials used	Tools used	Operations	Remarks
14/12/2023	i) 8 mm ϕ steel bar ii) Rod binding wire iii) 10 mm ϕ 1 longitudinal bar	i) Bench vise ii) Measuring tape iii) Chalk or pencil iv) Hacksaw v) Dye vi) Hook vii) Hammer	i) Measuring ii) Marking iii) Cutting iv) Striking v) Bending vi) Binding	

Procedure :

a) Firstly, a 8 mm ϕ m/s bar is taken.

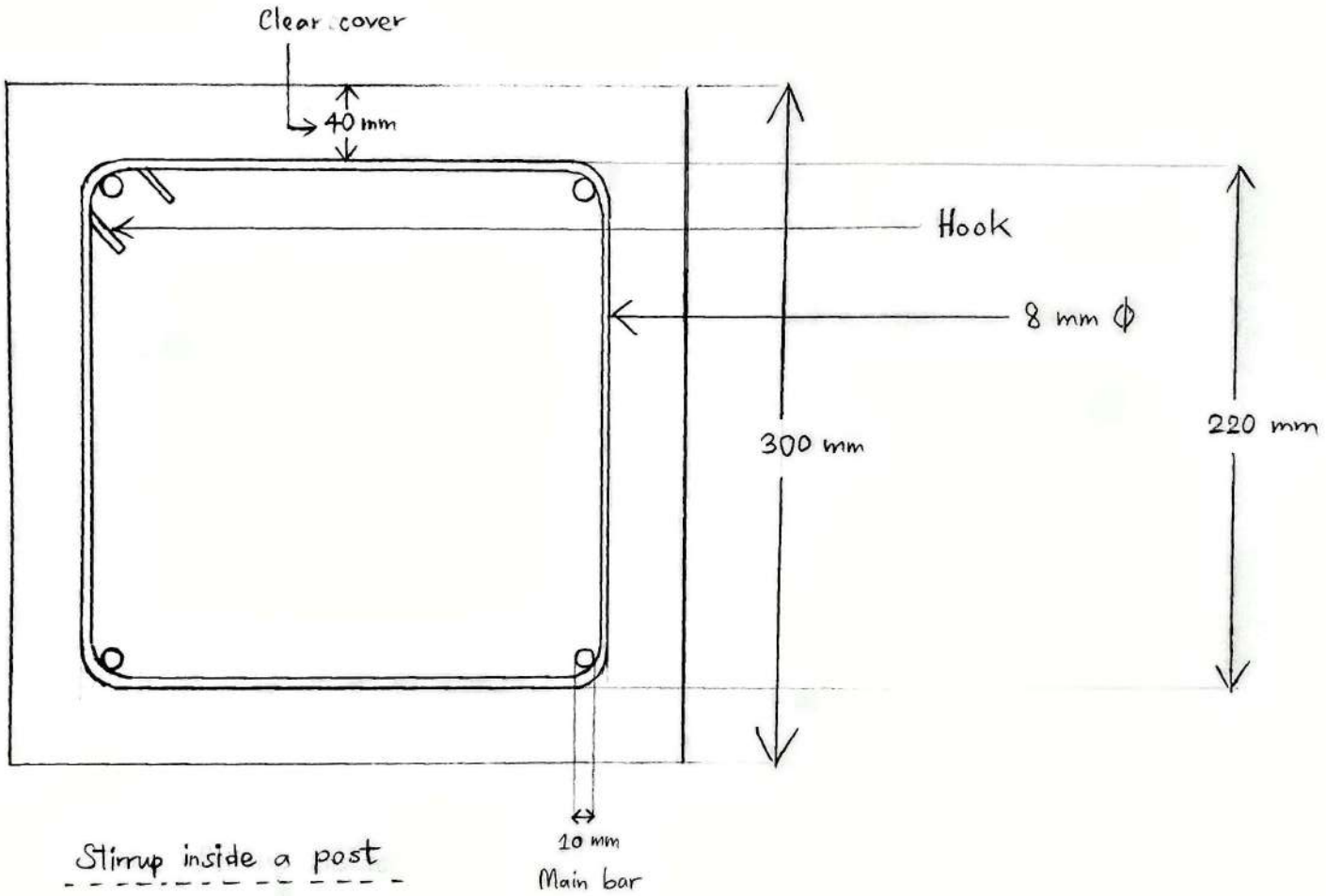
b) The bar is then measured and marked according to calculation.

c) The bar is then cut according to marking points.

d) The bar is straightened and striked with hammer before bending.

e) The dye is bent using dye on a wooden base with nail stops.

f) After bending, the stirrup properly with equal sides and right angles, then it is bound with main bars using black iron wires with help of hook.



Cross Section of an R.C.C. post